forward portion of the frame, a plurality of skating wheels rotatably mounted on the frame rearward of the slot for rotation in a common plane, at least one counter-rotatable braking device rotatably attached to the frame approximately in line with the axes of the slots, the braking device comprising means to allow rotation of the device in one direction and to resist rotation in the other direction, an axle slidably mounted in the slots, and at least one braking wheel mounted on the axle, such that the braking device and the braking wheel are in a common plane of rotation and such that when both the front skating wheel and the braking wheel are in contact with the skating surface, the braking wheel contacts the braking device at a point approximately vertically above the contact point between the braking wheel and the skating surface and wherein the braking device is oriented to allow rotation of the braking wheel against the skating surface in the forward skating direction and to resist rotation of the braking wheel against the skating surface in the reverse skating direction.

Another version of the replacement section marked up to show all changes is provided in the attached amendment paper (wherein omitted material is shown in brackets and added material is underlined).

Response

Applicant has canceled claims 5-7, 12-14, 19-21 and 26-28 in accordance with the Examiner's restriction requirement. Applicant has amended claims Claims 1-4, 8-11, 15-18, 22-25, and 29 to more particularly describe and claim applicants' invention, and not for any reason related to patentability. Additionally, claims 15-18 have been rewritten so that they are dependent on amended claim 15. No new matter is added by

this amendment. Applicant submits that these claims as amended are in condition for allowance.

Applicant has also amended the specification to more particularly describe applicant's invention. No new matter is added by this amendment.

Applicant respectfully requests reconsideration of the rejection of the claims of the present application in light of the foregoing amendments and the following remarks. Claims 1-4, 8-11, 15-18, 22-25, and 29 remain pending in this application. Although the Examiner has indicated that claims 8-11 are among the claims in this application that have been withdrawn from consideration, applicant believes that these claims are directed to the elected species 1, and requests reconsideration of the Examiner's withdrawal of these claims on that basis.

Before discussing the Examiner's specific ground of rejection, it would be useful to briefly review the claimed invention, which is generally directed to an apparatus and method for providing a skate with a braking wheel that will rotate freely if accidentally applied while skating in one direction, and provide anti-skid braking for skating in the other direction. The unidirectional braking action results from the use of a clutch bearing or other unidirectional component for the braking device.

The anti-skid braking results from less frictional contact (braking) force from the braking device on the top of the braking wheel than the frictional contact (traction) force from the skating surface on the bottom of the braking wheel. The condition of less frictional contact force on the top of the braking wheel than on the bottom results from three unique aspects of the invention's configuration:

Fig. 10

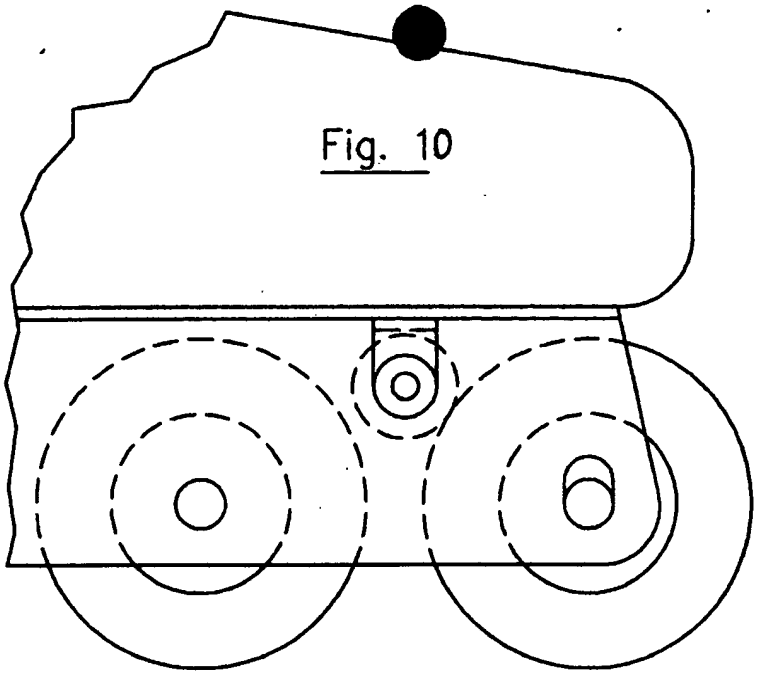
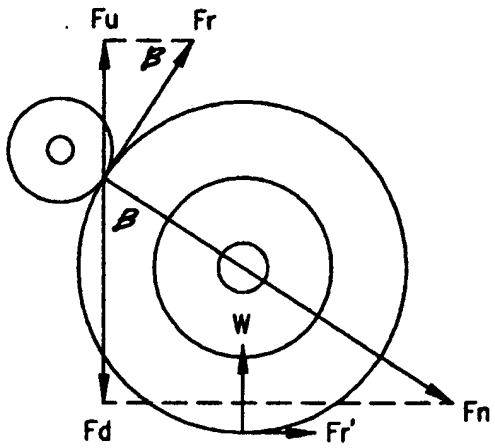


Fig. 20




WHEN:

Fr = THE FRICTIONAL FORCE OF THE ROLLER ON THE WHEEL IN THE BACKWARD SKATING DIRECTION.

Fu = THE VERTICAL COMPONENT OF Fr.

Fn = THE NORMAL FORCE OF THE ROLLER ON THE WHEEL IN THE BACKWARD SKATING DIRECTION.

Fd = THE VERTICAL COMPONENT OF Fn.

$\beta$ = THE ANGLE BETWEEN VERTICAL AND A LINE BETWEEN THE CENTER OF THE ROLLER AND THE WHEEL.

W = THE VERTICAL FORCE OF THE SURFACE AGAINST THE WHEEL.

Fr' = THE FRICTIONAL FORCE OF THE SURFACE ON THE WHEEL IN THE BACKWARD SKATING DIRECTION.

$\mu$ = THE COEFFICIENT OF FRICTION BETWEEN THE ROLLER AND THE WHEEL.

$\mu'$ = THE COEFFICIENT OF FRICTION BETWEEN THE SURFACE AND THE ROLLER.

THEN:

$\cos\beta = Fd / Fn$ ; $Fd = Fn \cos\beta$

$\sin\beta = Fu / Fr$ ; $Fu = Fr \sin\beta$

$Fd = W + Fu$ ; $Fd = W + Fr \sin\beta$ ; $Fn \cos\beta = W + Fr \sin\beta$

$Fr = Fn\,\mu$ ; $Fn = Fr / \mu$ ; $Fr \cos\beta = W\mu + Fr\mu \sin\beta$

$W\mu = Fr \cos\beta - Fr\mu \sin\beta$ ; $W\mu = Fr ( \cos\beta - \mu \sin\beta)$ ; $Fr = \dfrac{W\mu}{\cos\beta - \mu \sin\beta}$

$Fr' = \mu' W$

IF:

$\beta = 50°$ ; $\mu = 0.7$ ; $\mu' = 0.9$

THEN:

Fr = 5.5 W AND Fr' = 0.9 W

1) the braking wheel is mounted to allow displacement during braking in an approximately vertical direction (and thus all of the vertical force from the skater's weight on the skating surface is transferred through the braking wheel to the braking device);
2) the braking wheel contacts the braking device at a point approximately vertically above the contact point between the braking wheel and the skating surface, as shown in Figure 2 of the pending application (and thus, the normal force applied between the braking device and the braking wheel is equal to portion of the skater's weight supported by the braking wheel); and
3) the coefficient of friction between the braking wheel and the skating surface is greater than the coefficient of friction between the braking wheel and the clutch bearing case.

As shown on the attached sheet of drawings and calculations, Fig. 20 illustrates the vector diagram for analyzing the frictional force applied to a braking wheel, which is mounted in a vertical slot, by a braking device. Fr, the frictional (braking) resistance, is equal to the normal contact force Fn against the wheel multiplied by the coefficient of friction ($\mu$) between the contacting surfaces. As shown in the accompanying formulas, the vertical component of the applied force, Fd, is equal to the normal contact force Fn multiplied by the cosine of $\beta$, the angle between vertical and a line between the axes of the braking wheel and the braking device. Thus, if the weight is applied by the braking device in a nearly vertical direction, as illustrated in Fig. 2 of the pending application, then B will be approximately zero degrees, the cosine of $\beta$ will be approximately 1.0, and the normal contact force Fn will be equal to the skater's supported weight.

Consequently, due to factors 1 and 2 above, the normal forces applied to the top and bottom surfaces of the braking wheel are equal. Because the resulting rotational fictional force applied to the surface of the braking wheel is the product of the normal force and the coefficient of friction between the surfaces, given factor 3, the resulting rotational fictional force applied to the braking wheel by the skating surface is greater than the rotational fictional force applied to the braking wheel by the braking device. Thus, because the traction frictional force exceeds the braking frictional force, antilock braking is achieved.

It is also important to note that, if the weight is applied by the braking device in other than a nearly vertical direction, then the normal force, and consequently the braking frictional force increases substantially due to the "wedge" effect forcing the braking device against the braking wheel. As is illustrated in Fig. 20 of the attached calculation sheet, when $\beta$ is fifty degrees, the coefficient of friction between the braking wheel and the braking device is 0.7, and the coefficient of friction between the braking wheel and the skating surface is 0.9, the resulting potential rotational fictional (braking) force applied to the braking wheel by the braking device, Fr, is equal to 5.5 times the skater's supported weight. By comparison, the resulting potential rotational fictional (traction) force applied to the braking wheel by the braking device, Fr', is only 0.9 times the skater's supported weight. Thus, the potential braking force exceeds the traction force available to hold the braking wheel to the skating surface by a factor of six. Thus, skidding will result, and antilock braking cannot be achieved.

In the office action, the Examiner has rejected claims 1, 2, 15, 16, and 22-25 under 35 U.S.C. § 103(a) as unpatentable over Johnson U.S. Patent No. 5,924,704 in

view of Moore U.S. Patent No. 5,873,583. The Examiner asserts that Johnson discloses most of the limitations set forth in the rejected claims; however, the Examiner notes that Johnson discloses only a braking system in the rear portion of a roller skate. The Examiner further asserts that Moore discloses a braking system in the front of a roller skate and states that it would have been obvious to modify Johnson's braking system to locate it on the front of the skate.

However, Johnson discloses none of: 1) a braking wheel that is mounted to allow free displacement of its axle 2) in a direction approximately in line with the axis of the braking device; 3) a braking wheel which contacts the braking device at a point approximately vertically above the contact point between the braking wheel and the skating surface; or 4) the use of a braking device having a coefficient of friction with the braking wheel that is less than the coefficient of friction between the braking wheel and the skating surface. By contrast, Johnson discloses a braking device which is inserted between, not above, two braking wheels. Therefore, because the braking device is in contact with both braking wheels, it is impossible for it to be located above either wheel. As explained above, as in the hypothetical case posed by the Examiner of relocating the braking device of Johnson to the front wheels and reversing the direction of skating, due to the "wedge" effect, the potential braking force substantially exceeds the traction force available to hold the braking wheel to the skating surface. Again, skidding will result, and antilock braking cannot be achieved.

Further, Johnson does not disclose a means for allowing displacement the braking wheel in a direction approximately in line with the axis of the braking device. By contrast, Johnson teaches the use of a braking device having its axis located

approximately ***fifty degrees from vertical*** from the axis of the braking wheel. Because Johnson discloses only vertical movement of the wheel ("a wheel that is movable, ***up and down***, in a ***perpendicular direction to the road surface*** and is biased toward the road surface" (col. 1, ln. 38-40), Johnson cannot disclose displacement of the braking wheel in a direction approximately in line with the axis of the braking device.

Additionally, in Johnson, only one of the two braking wheels is mounted on a movable axle, and this movement is nether in the direction of the axle of the braking device, nor is it unrestricted movement as in the claimed invention. Rather, in Johnson the axle of the movable braking wheel is mounted in an "elastomeric insert 23 which provides ***downward force*** for wheel 2" (col. 3, ln. 6-7, 17-18), which causes the wheel to be "biased toward the road surface" (col. 1, ln. 38-40). This downward force from the elastomeric insert partially supports the skater's weight, and consequently, does not allow all of the vertical force from the skater's weight on the skating surface to be transferred through the braking wheel to the braking device, as in applicant's invention.

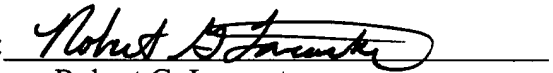
Furthermore Johnson does not teach the use of a braking device, such as a clutch bearing case, having a coefficient of friction with the braking wheel which is less than the coefficient of friction between the braking wheel and the skating surface. Accordingly, Johnson does not teach the elements of applicant's invention which provide effective antiskid braking, and an obviousness rejection is not supported.

The Examiner also rejects claims 3, 4, 17, 18, and 29 under 35 U.S.C. § 103(a) as being obvious over Johnson in view of Moore as applied to claims 1, 2, 15, 16, and 22-25, and further in view of Riutta U.S. Patent No. 5,192,099. The Examiner asserts that Riutta discloses the use of slots at a rearward incline. As pointed out above,

Johnson does not teach the elements of applicant's invention which provide effective antiskid braking, including, 1) a braking wheel that is mounted to allow free displacement of its axle 2) in a direction approximately in line with the axis of the braking device; 3) a braking wheel which contacts the braking device at a point approximately vertically above the contact point between the braking wheel and the skating surface; and 4) the use of a braking device having a coefficient of friction with the braking wheel that is less than the coefficient of friction between the braking wheel and the skating surface. Because Johnson does not disclose these claim elements, it cannot serve as the basis for an obviousness rejection of applicant's claims 3, 4, 17, 18, and 29.

It is respectfully submitted that the foregoing amendments and remarks overcome the basis of the rejection of the claims under 35 U.S.C. § 103(a). Prompt and favorable reconsideration is respectfully requested. The examiner is encouraged to contact the undersigned via telephone to resolve any outstanding issues.

Respectfully submitted,

By: 

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## AMENDMENT PAPER

The amended claims, marked up to show all the changes relative to the previous version (wherein omitted material is enclosed within brackets and added material is underlined), is as follows:

1. (amended) An in-line roller skate for skating on a skating surface comprising:

a boot for supporting the foot of a user,

a frame secured to the boot,

a plurality of skating wheels rotatably mounted on the frame for rotation in a common plane,

at least one counter-rotatable braking device rotatably attached to the frame comprising means to allow rotation of the device in one direction and to resist rotation in the other direction, and

at least one braking wheel rotatably attached to the frame forward of the skating wheels by means for mounting the braking wheel [in contact with the braking device at least when the skate is tilted forward] <u>which allow displacement of the axis of the braking wheel in a direction approximately in line with the axis of the braking device and which allow the braking wheel to contact the braking device, such that when both the front skating wheel and the braking wheel are in contact with the skating surface, the contact point between the braking wheel and the braking device is approximately vertically above the contact point between the braking wheel and the skating surface.</u>

**8.** (amended) The in-line roller skate of Claim **1** wherein the [contact point between the braking wheel and the braking device is approximately vertically above the contact point between the braking wheel and the skating surface when both the front skating wheel and the braking wheel are in contact with the skating surface] mounting means allows displacement of the axle of the braking wheel in an upward direction inclined approximately twenty-five degrees rearward from vertical.

**15.** (amended) A method of allowing an in-line roller skate to roll on a skating surface in one direction and to resist rolling in the other direction, the skate comprising a boot for supporting the foot of a user, a frame secured to the boot and a plurality of skating wheels on the frame for rotation in a common plane, the method comprising:

attaching at least one counter-rotatable braking device to the frame, the device comprising means to allow rotation of the device in one direction and to resist rotation in the other direction, and

mounting at least one braking wheel to the frame forward of the skating wheels [so that the braking wheel is in contact with the braking device at least when the skate is tilted forward] to allow displacement of the axis of the braking wheel in a direction approximately in line with the axis of the braking device and to allow the braking wheel to contact the braking device, such that when both the front skating wheel and the braking wheel are in contact with the skating surface, the contact point between the braking wheel and the braking device is approximately vertically above the contact point between the braking wheel and the skating surface.

The replacement paragraph number 11 of the specification, marked up to show all the changes relative to the previous version of the paragraph (wherein omitted material is enclosed within brackets and added material is underlined), is as follows:

11. Broadly, in another aspect, the present invention concerns an in-line roller skate for skating on a skating surface comprising a boot for supporting the foot of a user, a frame secured to the boot having a pair of parallel elongated slots in the forward portion of the frame, [the slots having approximately vertical axes,] a plurality of skating wheels rotatably mounted on the frame rearward of the slot for rotation in a common plane, at least one counter-rotatable braking device rotatably attached to the frame approximately in line with the axes of the slots, the braking device comprising means to allow rotation of the device in one direction and to resist rotation in the other direction, an axle slidably mounted in the slots, and at least one braking wheel mounted on the axle, such that the braking device and the braking wheel are in a common plane of rotation and <u>such that when both the front skating wheel and the braking wheel are in contact with the skating surface,</u> the braking wheel contacts the braking device at a point approximately vertically above the contact point between the braking wheel and the skating surface and wherein the braking device is oriented to allow rotation of the braking wheel against the skating surface in the forward skating direction and to resist rotation of the braking wheel against the skating surface in the reverse skating direction.